WSDOT

Quality in Design-Build

Roger Millar, Secretary of Transportation

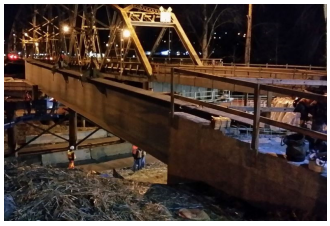
Safety

- Sign-in
- Who is CPR Qualified?
- AED
- Who will call 911?
- Evacuation
- Restrooms
- Breaks

Course Overview

- **Quality in Procurement**
- **Quality in Design**
- **Quality in Construction**

Quality in Procurement



WSDOT 4

Quality Starts at the Beginning

- **Project Goals**

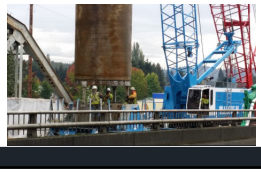
  "Excellent Quality: Meet or exceed technical requirements for design and construction through implementation of a clear and thorough Quality Management Plan."

WSDOT 5

Request for Qualifications SR 167/Puyallup River Bridge

Major Participants evaluated individually and as a project team

"Experience successfully managing a mature QC/QA process to ensure all work and materials meet or exceed contract specifications. Design-Build experience successfully managing QC/QA will receive a higher score."



WSDOT 6

Request for Proposals
SR 167/Puyallup River Bridge
Quality Management Plan Contents

- Organizational Chart
- Narrative
  - Role of QA/QC organizations for design and construction
  - Availability of staff
  - Training
  - Communications
- Description of early QA/QC use
- Maximum Technical Credits $650,000

QMP Preparation

DESIGN-BUILD
QUALITY MANAGEMENT PLAN OUTLINE

DESIGN-BUILD PROJECT

Key Considerations to Writing QMP

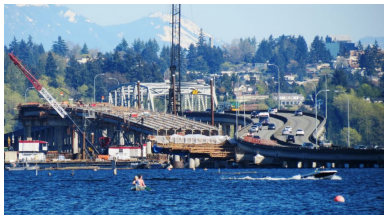
- Commitment for QMP to supporting the contract
- Key Personnel requirements & Training
- Document Control
- Process requirements
- Off-site project control requirements
- Design–Builder QA/QC Materials Testing and Inspection Plan
- Hold Point Requirements
- NCI/NCR Process
- Final Acceptance

QMP Technical Requirements

- RFP Chapter 2
  - Section 2.28
- Governing requirements for the Project
- Baseline for Construction Audit Tracking System ("CATS")

WSDOT 10

Quality in Design



WSDOT 11

What's QV and How Does It Assess QA and QC?

- Owner verification of the Design-Builder's QA process and QC production in all facets of work.
- What processes are critical to meeting the contract?
- How is the Design-Builder going to behave; how should they behave?
- Where's your confidence level?

WSDOT 12

The Quality Task Force (QTF) Meeting Design Related Aspects

- Formed by Design-Builder at the beginning of the project
- Meets Weekly
- Reviews activities
- Gives status of Discipline specific task force meetings

WSDOT 13

Design Quality Responsibilities

Design-Builder
- Design Quality Control

Design-Builder
- Design Quality Assurance

WSDOT
- Design Quality Verification

WSDOT 14

Design QC and QA - (Design-Builder)

- Detailed Checks
- Constructability
- Managing Design Review Process
- Documentation
- Review and Approve "Release for Construction" (RFC) Plans
- Review and Approve Design Changes NDC and FDC
- Stamp RFC Plans

WSDOT 15

Design QV - (WSDOT)

- **Available for questions**
- **"Over the Shoulder" reviews**
- **Timely reviews**
- **Audit of Design QA records and processes**
- **Verifying progress for payment**
- **Communication regarding successful completion**

WSDOT 16

WSDOT QV Roles and Responsibilities

- Roles / Responsibilities Overview:
  - Project Engineer / Assistant Project Engineer
  - Design Manager – Lead Auditor
  - Design Discipline Leads / Reviewers – Auditor
  - Office Engineer – Lead Auditor
  - Chief Inspector – Lead Auditor
  - Construction Compliance Inspectors – Auditor
  - Environmental Compliance Inspector – Auditor
  - Materials Engineer – Auditor
  - Construction Compliance Testers – Auditor
  - Office Support Staff – Auditor

WSDOT 17

Design Submittal Reviews

Conducted at the following points:

- Preliminary Design
- Final Design
- Release for Construction Plans
- Design Changes (FDC and NDC)
- As-Built Plans

WSDOT 18

Quality in Construction

WSDOT 19

Design-Builder QC/QA Structure

- Quality Control Structure:
  - Project Manager, Construction Manager, Design Manager, Superintendents, Foreman, Field Engineers, Subcontractors and Suppliers
- Quality Assurance Structure:
  - Qualified testers and inspection staff must be independent from Quality Control
  - Quality Manager must report to person or group with overall project management responsibilities

WSDOT 20

The QTF (Quality Task Force meeting)

- **Formed by Design-Builder at the beginning of the project**
- **Meets Weekly**
- **Reviews activities**
- **Resolves NCR's/NCI's**

WSDOT 21

WSDOT QV Responsibilities

WSDOT QV Responsibilities - Field

- Project Oversight
- Quality Verification
- Testing HMA – we are QA for HMA testing
- Fabrication Inspection – we are QA for Fabrication Inspection

WSDOT QV Responsibilities - Office

- Document Control
- Review and Approve QMP
- Materials Review
- Payments and Change Orders

WSDOT 22

WSDOT Construction Verification Activities

- **Check the Design-Builder's construction QA Staff**
- **Verify progress of project**
- **QV Audits**
- **Verify work paid based on progress**
- **Review as-built plans**

WSDOT 23

Audit Plan

- **Why do we need Audit Plan?**
- **What are we auditing?**
- **When are we auditing?**
- **Process or Product?**
- **High Risk v. Low Risk**
- **Frequency on a "Global Project Scale"**

WSDOT 24

CATS

Construction Audit Tracking System ("CATS")

- WSDOT's software tool for Quality Verification audits of design, construction, and other aspects of the contract
- Prepare for the audit from the beginning of the project.
- Checklists are created from the RFP
- Audit Frequency
  - 2-5 x week for first 6-9 months (or throughout for shorter projects)
  - 1-3 x week once confident in process

WSDOT 25

The Audit Phases

Audits should examine all phases of the QA and QC work or process in:

- Business (general requirements, administration and DBE)
- Design
- Construction (discipline specific inspection and monitoring)
- Field Design Changes & Nonconformance remediation proposals
- Quality (QMP, materials, placement and submittals)
- Environmental
- Submittals
- Maintenance of Traffic (MOT)
- Utilities
- Safety

WSDOT 26

"Shall we"

- **Audit criteria are extracted from the "shall" statements**
  - Proposal Betterments
  - General Requirements
  - Technical Requirements
  - Standard Specifications
  - Appendices
  - Management Plans
  - Permit Requirements.

WSDOT 27

The Statement

Make each "shall" statement into a question.

For example, if the RFP says:

"Prior to the start of any Work activity, the Design-Builder shall hold Pre-Activity Meetings to ensure that all Project personnel have a thorough understanding of the Work to be accomplished."

WSDOT 28

The Question

The question would read,

"*Prior to the start of any work activity, did the design-builder hold pre-activity meetings to ensure that all project personnel have a thorough understanding of the work to be accomplished?*"

WSDOT 29

The Resources

- **Each RFP chapter, appendix, or permit requirement can be made into a Project Engineer's checklist.**
- **Each checklist becomes table from which a situation specific audit can be assembled.**

WSDOT 30

The Approach

Each Auditor should perform audits initially

- Long Duration Projects: (1½ years and greater):
  2 to 5 times a week for the first 6 to 9 months
  1 to 3 times per week thereafter
- Short Duration Projects (single season construction)"
  2 to 5 times a week

WSDOT 31

The Chronicle

- **Auditors maintain an electronic or hard copy diary for those days that audits aren't performed**
- **An IDR narrative section or PE diary are good formats**

WSDOT 32

Cherries and Pits

- **Each audit should contain between 5 to 15 questions or audit items.**
- **Single-item audits (*cherry picking*) tend to only note nonconformance**
  - Use sparingly

WSDOT 33

The Work or Process

Audit items pertain to the work that

- has been completed to that point, or
- is ongoing work that requires certain intermediate steps (**hold points**) be completed prior to the work being completed.

WSDOT 34

The Observation, Good and Bad

- **Comment area**
- **Acceptable area/box**

WSDOT 35

The Observation, Good and Bad; part 2

Each audit item has an “acceptable area or box” where there are really only 2 options; yes, no, (N/A really doesn’t function in the software).

- Each audit item that receives a “yes” says by the auditor’s observation the work meets contract requirements.
- Each audit item that receives a “no” says by the auditor’s observation the work does not meet contract requirements and is a nonconformance issue or “NCI.”

WSDOT 36

Form of Audit Questions

Audit questions should pertain to the deliverable function of the work or process

- **Who?**
- **What?**
- **Where?**
- **Why?**
- **How?**
- **When?**

WSDOT 37

WSDOT 38

Materials Quality Responsibilities

- Design-Builder's Supplier: Materials Quality Control
- Design-Builder: Materials Quality Assurance
- WSDOT: Materials Testing Quality Verification
- WSDOT: Acceptance Testing
- WSDOT: Materials Independent Assurance

WSDOT 39

WSDOT Materials Inspection

- **Materials Inspection =**
  Verification sampling and testing
- **Material Certification =**
  Collect and maintain material certifications

WSDOT 40

Statistical Analysis of Materials (SAM)

- **Computer Program that evaluates materials according to the WSDOT Standard Specifications**
  - Generates verification reports
  - Can be sent electronically to WSDOT and outside entities
- **Design-Builder inputs all QA testing data**
- **WSDOT enters all QV data**
- **Determines whether an F & t analysis is required**

WSDOT 41

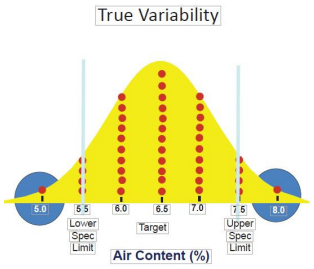
F & t Analysis

- Method of comparing two independent sets of data to determine whether the materials came from the same population
- **F Test:**
  Test the assumption that the variances are equal
- **t Test:**
  Test the assumption that the means are equal

WSDOT 42

The F Test

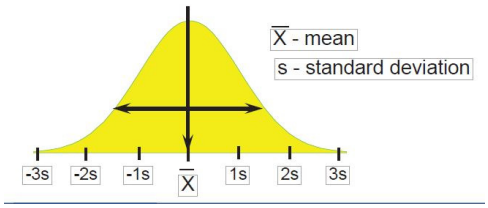
Do the bell curves look alike?



WSDOT 43

The t test

How do do the bell curves overlap?



WSDOT 44

The False Positive

Lessons learned

- Two uppermost sieves
- Embankment and surfacing density
- Concrete compression
- F & t for validation

WSDOT 45

The Anomaly

- "F" value exceeds the "F critical" value or "t" value exceeds the "t critical" value
- CQAM brings F & t analysis to QAT or QTF
- Data checked
- IAI reviews
- QV results used if no IA findings or QA justifications can corroborate QA test result

WSDOT 46

Hold Points

- Critical characteristics are measured
- Established where QA inspection is mandatory
- Three calendar days' notice
- Listed in the RFP
- Listed in all inspection and test plans

WSDOT 47

NCR's and NCI's

- Nonconformance Reports (NCR)
  - Written by the Design-Builder
  - Usually product or workmanship
- Nonconforming Issues (NCI)
  - Written by WSDOT
  - Usually process related

WSDOT 48

Nonconformance is both sides' responsibilities

With NCR's being the Design–Builder's responsibility to identify, remediate, eliminate from reoccurrence and log; the owner or WSDOT must have a separate but equivalent system for overall performance that captures our observation of nonconformance.

WSDOT 49

Resolution

These nonconformance reports and issues must be resolved within the QTF framework. Although not necessarily during the actual meeting the initial discovery and the resolution must be tracked by the CQAM and the QTF.

WSDOT 50

Effect of WSDOT Audits and Reviews

- **WSDOT reviews are an important tool to manage and monitor the performance of the contract.**
- **WSDOT reviews and audits do *not* transfer the risk of meeting the contract requirements.**

WSDOT 51

Lessons Learned

- Start the quality process in the procurement
- Be diligent in documentation
- Become familiar the new and different role WSDOT plays in quality for design-build

WSDOT Design-Build Training

The WSDOT Design-Build Training Courses have the following modules:

- **In Person Courses:**
  - Design-Build 101 *(Prerequisite to this course)*
  - Design-Build Startup: Development of the Request for Qualifications and Instructions to Proposers
  - Design-Build Request for Proposals
  - Design-Build Office Management and Contract Administration
  - Design-Build Closeout Process
  - Environmental Issues in Design-Build
  - Quality Control/Quality Assurance in Design-Build
- **Online Courses:**
  - Statement of Qualifications Evaluation
  - Proposal Evaluation
  - Alternative Technical Concept Evaluation

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Resources

- WSDOT Design-Build Web Page
  http://www.wsdot.wa.gov/Projects/delivery/designbuild/Default.htm
- Joint Transportation Committee of Washington State Legislature Design-Build Study
  http://leg.wa.gov/JTC/Pages/Design-Build-Study.aspx
- WSDOT Design-Build Templates
- http://sharedot/eng/cn/hqconstr/dpb/DB%20Templates/Forms/AllItems.aspx
- Design-Build Institute of America Best Practices
  https://www.dbia.org/resource-center/Pages/Best-Practices.aspx
- Design-Build Institute of America Transportation Conference
  www.dbia.org

WSDOT 55

Questions

WSDOT 56